OWNERS MANUAL

HF – Micro 1000 Laboratory Turbidimeter
0-10,000 NTU

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Catalog No. 22615 (2/04)

Rev. 1.9

DECLARATION OF CONFORMITY

Application of Council Directive: 73/23/EEC

Standard to which Conformity is Declared:

Product Safety	**Immunity & EMI**
UL3101-1	**EN61326: 1998**
CSA-C22.2 No. 1010-1-92	**EN61000-3-2: 2000**
EN61010-1: 1993 + A2: 1995	**EN61000-3-3: 1995**

Manufacture's Name: **HF scientific, inc.**

Manufacture's Address: **3170 Metro Parkway, Fort Myers, Florida 33916-7597**

Importer's Name:

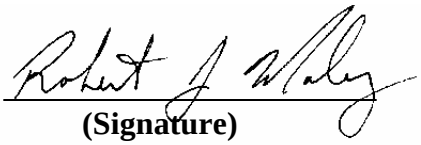
Importer's Address:

Type of Equipment: **Laboratory Turbidimeter**

Model No.: **Micro 1000** **Catalog Numbers:** **20013/20014**
Micro 1000 IR **20015/20016**

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive and Standard.

Place: **Fort Myers, Florida USA**



(Signature)

Robert J. Maley, President

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1. SPECIFICATIONS

	MICRO 1000	MICRO 1000IR
Instrument Conformance	Conforms to specifications set forth in EPA method 180.1 (Nephelometric Method)[§]	Conforms to specifications set forth in ISO 7027: Water Quality –Determination of Turbidity
Light Source	Tungsten Filament Lamp	Infrared LED
Measurement Options and Ranges NTU FNU EBC NEPHELO FAU	Ratio on or Ratio off 0 – 10,000 -------- 0 - 2,450 0 – 67,000 --------	Ratio on or Ratio off 0 – 10,000 0 – 10,000 0 – 2,450 -------- 0 – 10,000
Signal Averaging	Yes	Yes
Auto Ranging	Yes	Yes
Accuracy [†] 0 – 1000 NTU 1000 – 4000 NTU 4000 – 10,000 NTU	 ± 2% of reading + 0.01 NTU ± 5% of Reading ± 10% of Reading	 ± 2% of reading + 0.01 NTU ± 5% of Reading ± 10% of Reading
Repeatability	± 1% of reading or ± 0.01 NTU whichever is greater	± 1% of reading or ± 0.01 NTU whichever is greater
Resolution	.001 NTU between 0 – 1 NTU	.001 NTU between 0 – 1 NTU
Response Time	Less than 6 seconds	Less than 6 seconds
Serial Input/Output	RS-232 Directional	RS-232 Directional
Certifications	CE, TÜV, GS	CE, TÜV, GS
Power Supply	15 V DC Wall Mount	15 V DC Wall Mount
Display	Backlit Multi-Line LCD	Backlit Multi-Line LCD
Miscellaneous Specifications	1 - Built in Diagnostics 2 - Security Access Code	1- Built in Diagnostics 2- Security Access Code
Operating Temperature Range	0° C – 50° C (32 ° F - 122° F)	0° C – 50° C (32 ° F - 122° F)
Sample Flow Rate Through The Flow Cell	0.5 – 1.5 gpm (2-6 L/min) 60 psi max pressure (414 kPa)	0.5 – 1.5 gpm (2-6 L/min) 60 psi max pressure (414 kPa)
Air Purge	0.1 SCFM at 10 PSIG	0.1 SCFM at 10 PSIG
Shipping Dimensions	12” x 14” x 12” (35.6cm x 30.5cm x 30.5cm)	12” x 14” x 12” (35.6cm x 30.5cm x 30.5cm)
Shipping Weight	7 lb (3.18 kg)	7 lb (3.18 kg)
Warranty	1 - Year	1 - Year

[§] The specifications found in EPA method 180.1 are essentially the same as the specifications set out in method 2130B of the Standard Methods for the Examination of Water and Wastewater 19th edition and the specifications set out in ASTM Standard Method D1889-94. This turbidimeter meets, or exceeds, the specifications set forth in these methods.

[†] Instrumental accuracy measured under controlled laboratory conditions at 25°C (77°F)

2. Overview

The Micro 1000 process turbidimeter allows you to measure the turbidity of your process water. The White Light Micro 1000 has been designed to meet the design criteria specified by the US EPA on turbidity measurement. The Infra-Red Micro 1000 (Micro 1000 IR) was designed to meet the design criteria specified in ISO 7027 and DIN 27027 for the measurement of the turbidity of a sample.

2.1. Unpacking and Inspection of the Instrument and Accessories

The table below indicates the items that you should find in your turbidimeter shipment.

ITEM	Quantity
Laboratory Turbidimeter	1
Calibration Kit for the MICRO 1000	1
3 Pack of Cuvettes	1
MICRO 1000 Instruction Manual	1
Power Supply	1

Remove the Calibration Kit (blue case found in the foam pack), The Package of 3 Cuvettes (blue case) and the instrument from the packing carton. Carefully inspect all items to ensure that no visible damage has occurred during shipment. If the items you received do not match your order, please contact your local distributor or the HF scientific, inc. Customer Service department immediately.

Note: Extra care should be taken when unpacking, opening, and handling the calibration standards and sample cuvettes in the Accessory Kit; surface scratches or finger smudges on the cuvette surface may cause measurement errors. Handle these items by the top area of the cuvette only.

2.2.User Interface

The user interface of the instrument is designed with a 6 key touch pad and a single user display. The six keys of the touch pad and their functionality are described below. Figures 1a and 1b are depictions of the front and rear views of the instrument.

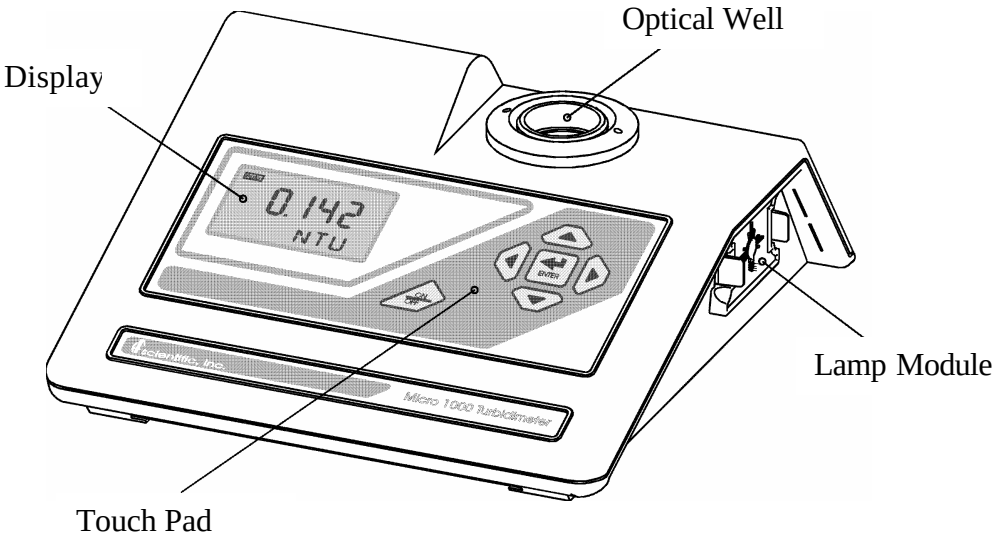


Figure 1a - Front view of the Instrument

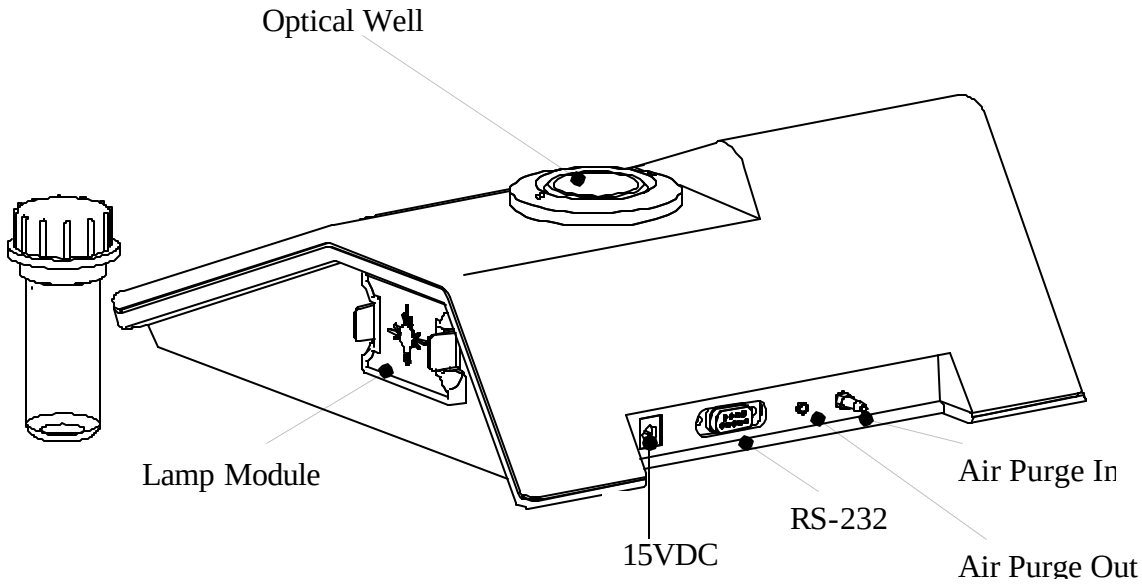


Figure 1b – Rear view of the Instrument

The ON/OFF key ( ) key is used to turn the instrument ON or OFF. The enter key ( ) is used to accept information. The up and down arrow keys (and) are used to set and reset numerical values and to change instrument modes. The left and right arrow keys (and) are used to scroll through lists. In addition, the rear panel of the instrument is designed to provide ready access to the power plug connector, the RS-232 serial port and the dry air purge connector.

Figure 2 illustrates all the items that can appear on the display. The upper row of the display (1) is used for reporting the turbidity levels and to provide user guidance in the customer setting routine. The lower row of the display (2) is used to communicate error messages and user guidance. The display has several status indicators (3) that distinguish the operation of the instrument. In addition there are several indicators that display the different scales (4) that the instrument will report. Other indicators (5) provide guidance when the setup and calibration routines are being used.

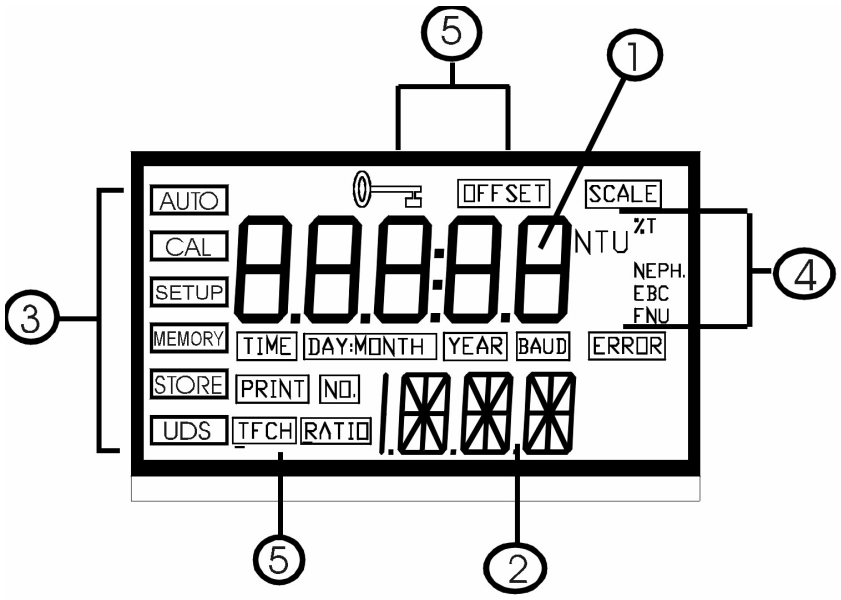


Figure 2 – Display used in the instrument. All items that are used on the display are shown in this figure

3. Safety

This manual contains basic instructions that you must follow during the commissioning, operation, care and maintenance of the instrument. The safety protection provided by this equipment may be impaired if it is commissioned and/or used in a manner not described in this manual. Consequently, all responsible personnel must read this manual prior to working with this instrument.

The instrument has a time-out feature that automatically returns the system operation to the normal operation mode from any other mode after a five (5) minute period of inactivity.

Ensure that the instrument has been turned off prior to removing power from the instrument.

In certain instances **WARNINGS, Notes**, or helpful hints, have been highlighted to give further clarification to the instructions. Refer to the *Table of Contents* to easily find specific topics and to learn about unfamiliar terms.

4. Routine Operation

4.1. Measurement Principle & Methodology

This instrument is designed to measure the turbidity of a sample in nephelometric turbidity units (NTU). In addition, the instrument is capable of measuring in several other standardized scales:

Scale	Definition	Applicable Instrument (s)	
		White Light	Infrared
Ratio - NTU	Turbidity measured via a combination of transmitted and 90° scattered light using the 90° scattered light as the primary detector signal. This is used to eliminate effects of colored samples.	Yes	Yes
FNU	Formazin Nephelometric Units (1 FNU = 1 NTU)	No	Yes
FAU	Formazin Attenuation Units (turbidity measured via transmitted light according to ISO 7027 and DIN 27027)	No	Yes
EBC	Turbidity scale of the European Brewery Commission	Yes	Yes
Nephelos	A turbidity scale used in microbiological research to report progress of bacterial growth (e.g. immunological assays). 6.7 Nephelos = 1 NTU. Nephelo is the Greek word for cloud.	Yes	No

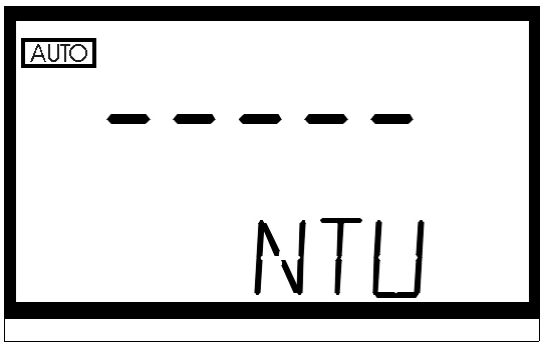
The system measures these scales using five (5) separate detectors. Two detectors are located 90° from the path of the light (nephelometric detectors) to ensure measurement redundancy and to minimize variations in cuvettes. One detector is a reference detector that monitors the light output by the light source (both white light and infrared). The reference detector is used to generate a more accurate measure of turbidity should there be any fluctuation in lamp intensity (via voltage spikes or lamp ageing). Finally, two detectors are used to measure transmission of light for the extended turbidity range, for ratio measurement, and for determination of FAU's (see below for definition).

In the course of normal operation, the embedded software measures the intensity of light at each detector. During this operation, several advanced fuzzy logic techniques are used to determine if air bubbles or large particles are passing through the path of light at the detector. If an anomaly is detected, the algorithm identifies it and repeats the measurement prior to reporting the turbidity levels. By monitoring all detectors, the instrument is able to perform system self-diagnostics; it is able to ensure that all data collected from the detectors is consistent. Then, the calculations for

turbidity are made according to the methods described in the specifications section of the instrument (section 1).

During normal operation, the **AUTO** block will be highlighted with the current scale displayed on the lower row of the display and the measured reading on the upper row of the display:

In certain instances, during normal operation, the instrument will display a row of dashes across the upper row of the display.



This indicates that either the instrument is performing an auto-ranging function, or the sample has not yet stabilized (e.g. air coming out of solution in the form of bubbles). The dashes should remain for a brief period of time (< 45 seconds). If the dashes remain for an extended period of time please contact the HF scientific, inc. Technical Services Department for further assistance and guidance.

The following sections describe how to use the instrument under normal operating conditions. These sections include details on how to take normal, routine turbidity measurements using the instrument.

WARNING: *NEVER* pour liquid directly into the sample well of the instrument: always use a cuvette. The instrument will accurately measure the turbidity of a sample using only cuvettes with the black light shield on the cuvette (provided by HF scientific, inc.), the optional pour through assembly, or the optional flow through assembly.

4.2. Grab Sample Measurement (Routine Measurement)

The following steps describe how to measure the turbidity of a grab sample using this instrument:

1. Turn on the instrument. The instrument will be in the normal operating mode. Allow instrument to warm up for at least 30 minutes.
2. Sample approximately 100 ml of the process stream as you would normally do for turbidity measurement.
3. Obtain a clean and dry sample cuvette.

4. Rinse the cuvette with approximately 20 ml of the sample water (2/3 of cuvette volume), capping the cuvette with the black light shield (cuvette top) and inverting several times. Discard the 20 ml of used sample and repeat the rinsing procedure two more times.
5. Completely fill the rinsed cuvette (from step 4) with the remaining portion (approximately 30 ml) of the grab sample and then cap the cuvette with the black light shield. Ensure that the outside of the cuvette is dry, clean and free from smudges.
6. Place the cuvette in the instrument and index the cuvette to the lowest reading (the displayed turbidity is updated once a second). Once the cuvette is indexed, the reading displayed on the instrument's display should be recorded as the sample turbidity (see Glossary for more information on indexing a cuvette).
7. If you have turned off the printer output in the customer setup section, pressing the ENTER key at this time will output data to the RS232 port.

Repeat steps 2 through 7 for all of your samples.

4.3. Pour Through Sample Measurement (Optional Accessory)

Install the pour through assembly and index it according to the instruction sheet that accompanies the assembly. The following steps describe how to measure the turbidity of a sample using the instrument fitted with the optional pour through assembly:

1. Turn on the instrument. The instrument will be in the normal automatic mode. Allow instrument to warm up for at least 30 minutes.
2. Sample approximately 500 ml of the process as you would normally do for turbidity measurement.
3. Pour the complete 500 ml sample into the pour through assembly. Record the turbidity of the sample displayed after the entire 500 ml sample has been poured into the assembly, the flow to drain has ceased, and after the reading has stabilized.
4. If you have turned off the printer output in the customer setup section, pressing the ENTER key at this time will output data to the RS232 port.
5. Repeat steps 2 through 4 for all of your samples.

The sample cuvette used in the pour through assembly is identical to the standard sample cuvettes supplied with the instrument. Clean the cuvette on a periodic basis according to your experience with the type and turbidity of the sample found in your facility.

4.4. Flow Through Sample Measurement (Optional Accessory)

Install the flow through assembly according to the instruction sheet that accompanies the assembly. The following steps describe how to continuously measure the turbidity of a sample stream using the instrument fitted with the optional flow through assembly:

1. Turn on the instrument. The instrument will be in the normal automatic mode. Allow instrument to warm up for 30 minutes.
2. Initiate flow of the sample to the instrument and allow 2 minutes for the flow to stabilize prior to recording the measured turbidity.
3. Begin to record the turbidity readings at the desired intervals.
4. If you have selected timed printer output in the customer setup section you should be able to monitor the process in real time using PC data acquisition software.

The sample cuvette used in the flow through assembly is identical to the standard cuvettes supplied with the instrument. Clean the cuvette on a regular basis according to your experience with the type of turbidity sample found in your facility.

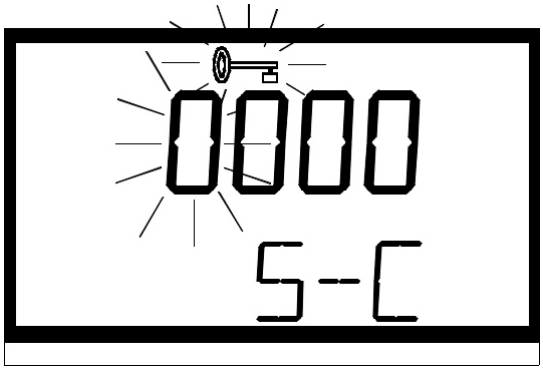
4.5. Dry Air Purge System

Cold samples, or the continuous flow of cool water through the flow-through cuvette may cause condensation on the walls of the cuvette. This condensation can cause faulty and erratic readings with the instrument. To eliminate this effect, a built in dry air purge system has been designed to optimally circulate air through the optical compartment and prevent this condensation. This is a particularly important feature when using either the pour through or the flow through option.

To use, connect the regulated dry air source to the air purge fitting on the rear panel of the instrument. The fitting is designed for use with 1/8" I.D. flexible tubing. Allow air to flow as long as needed to control condensation; dry nitrogen or instrument grade air up to 15 PSIG (103.5 kPa) should be used at flow rates between 2 – 7 SCFH. Once installed allow the system approximately 15 minutes to evacuate the chamber before proceeding with your measurements.

4.6. Using the Security Access Feature (Good Manufacturing Practice [GMP])

The instrument is equipped with a security feature that can be turned on, or off, when configuring the instrument. Two access codes are used in the instrument and configurable by the user (see section 8.3). The access code is required as an input whenever the user wishes to gain access to either the calibration routine or the configuration (setup) routine when the feature is enabled. Use either the ⏶ or ⏷ keys to select the mode that you wish to enter and then press the ↵ key. If the security code option is turned on you will see the following display:



This security code has four numbers that are selectable one at a time. The number that is flashing is the first number for you to select. Use either the ⏶ or ⏷ keys to select this number in the code then press the ↵ key to move to the next number. Follow this process through the four numbers in the access code. If you have selected a valid access code, the instrument will be directed to either the calibration or the configuration (user setup) mode depending on your original intention. If the wrong access code is selected, the instrument will return to the normal automatic mode.

5. Calibration Procedures

The instrument was calibrated and tested prior to leaving the factory using calibration standards that are traceable to the primary turbidity calibration standard, Formazin. Therefore, it is possible to use the instrument directly out of the box. However, re-calibration of the instrument is recommended to help you become familiar with the operation of the instrument and the calibration procedures.

Under normal conditions, re-calibration is recommended at least once every three months[1]. You may select a predetermined calibration interval for automatic prompting for calibration: if you exceed the selected calibration interval, the **"Cal"** block will flash until the instrument is re-calibrated.

During calibration, the instrument performs several system self-diagnostics. As such, several warning messages may be displayed. If the instrument detects an irregularity with the instrument (detectors or lamp) a warning message will be displayed on the lower row of the display on exit from the calibration mode. If this occurs please attempt to rectify the warning message yourself, or contact the HF scientific, inc technical services department. In any event, the instrument will continue to monitor the turbidity of the process water with a decreased accuracy until the error is rectified.

In addition, if the instrument remains in the calibration mode for longer than 5 minutes with no activity, it will time out and return to the automatic measuring mode.

Note: The instrument must be re-calibrated after lamp replacement.

5.1. Calibration Standards

HF scientific, inc. recommends that you use the following materials during calibration to achieve the accuracy stated in this manual:

1. 0.02 NTU PRIMELIME Calibration Standard available from HF scientific inc.
2. 10.0 NTU PRIMELIME Calibration Standard available from HF scientific, inc.
3. 100 NTU PRIMELIME Calibration Standard available from HF scientific, inc.
4. 1750 NTU PRIMELIME Calibration Standard available from HF scientific, inc.
5. 10000 NTU PRIMELIME Calibration Standard available from HF scientific, inc.

It is well known that diluted Formazin is unstable. If you choose to use Formazin to calibrate the instrument, ensure that you are using a fresh stock suspension of Formazin to achieve the accuracy quoted for the instrument. A Formazin Stock Solution Kit is available from HF scientific, inc. (Catalog No. 50040). The HF scientific, inc. PRIMELIME, primary calibration sets (Catalog No.19927 or 19928) are more stable than Formazin and have a minimum shelf life of 12 months. If you use the stable HF calibration standards to calibrate the instrument, review the expiration date to ensure that the standards have not expired.

Note: The calibration standards must be inverted (well mixed) prior to use to ensure the homogeneity and repeatability of the suspension for measurement.

5.2. Indexing the Calibration Standard(s)

The United States Environmental Protection Agency (US EPA) recommends that cuvettes used for instrument calibration or sample measurement be indexed. To comply with this recommendation, each HF scientific, inc. calibration standard is supplied with an indexing ring for quick and repeatable indexing of the calibration standards. To index a calibration standard perform the following two steps:

[1] The EPA recommends that on-line turbidimeters be calibrated with the primary standard at least once every three months if they are to be used for EPA reporting.

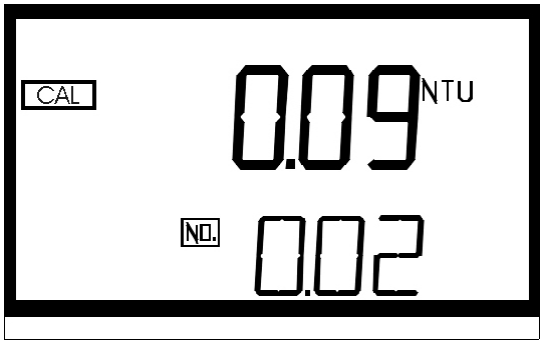
1. Slowly rotate the calibration standard one complete revolution (360°). While rotating the standard, observe the measured turbidity and locate the position of the cuvette having the lowest turbidity reading.
2. With the calibration standard positioned at the location having the lowest turbidity reading, install the Indexing Ring over the black light shield on the standard so that the pointer of the Ring faces forward, toward the operator.

When using the standards in the future, always insert the standard so that the pointer of the index ring faces forward. Slowly rotate the standard back and forth about 5° to find the lowest point. The standard is now indexed and ready to use.

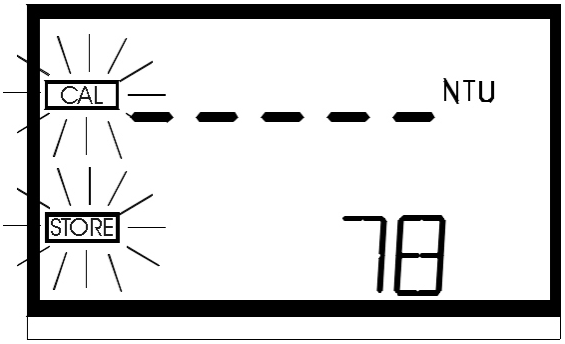
5.3. Calibrating the Instrument

Even though it is possible to calibrate the instrument using any sequence of the prescribed calibration standards, to achieve the stated accuracy you must use the procedure below to calibrate the instrument.

1. Select the calibration function of the instrument by pressing either the up or down arrow key until the **"Cal"** block is lit. Press the ↵ key. The cal block will now be lit and the turbidity displayed in the lower row of the display should read 0.02 NTU. This is the first standard that must be used in calibration.

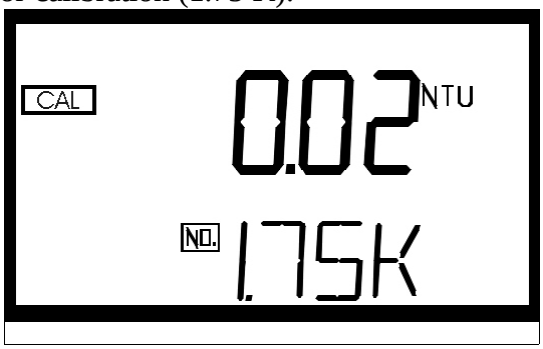


2. Insert the 0.02 NTU calibration standard into the sample well and index the standard if you have not already done so (see section 7.1). At this point press the ↵ key to initiate calibration on the 0.02 NTU standard. The instrument will calibrate on the 0.02 NTU level (the **"Cal"** block and the "**Store**" block will flash on and off for a period of time and you will see a countdown from 90).



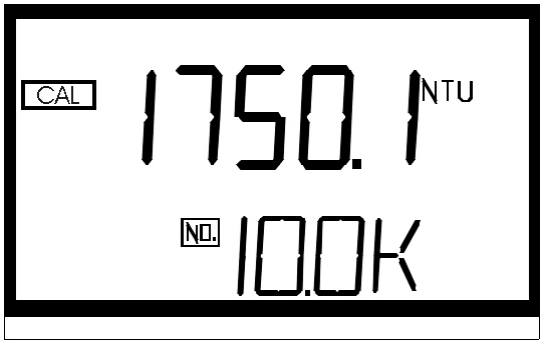
Note: The 0.02 NTU standard must be evaluated in calibration at both the start and end of calibration to ensure accurate measurements in the ratio mode and when recording FAU measurements.

3. When the instrument has completed the calibration, the **"Cal"** and the "**Store**" blocks will quit flashing and the lower row of the display should now indicate that the 1750 NTU standard is the next standard to be used for calibration (1.75 K).

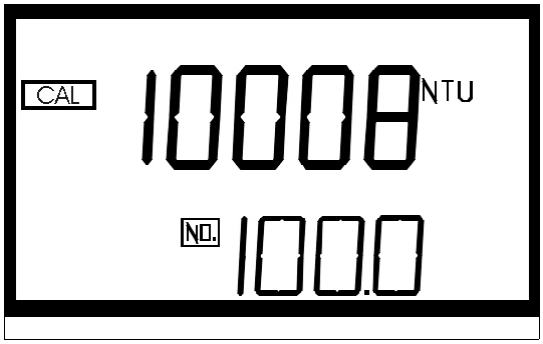


Press the ↵ key to indicate to the instrument that you plan to calibrate on this point.

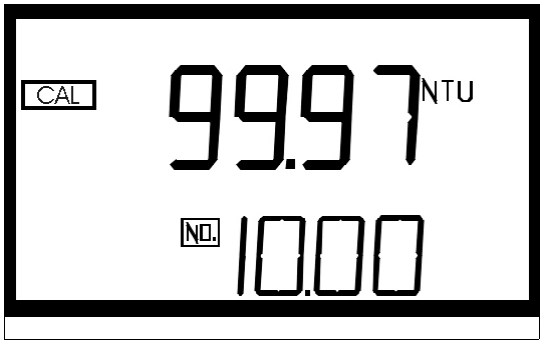
4. Insert the 1750 NTU calibration standard into the sample well and calibrate as before. When the instrument has completed the calibration, the **"Cal"** and the "**Store**" blocks will quit flashing and the lower row of the display should now indicate that the 10000 NTU standard is the next standard to be used for calibration (10.0 K).



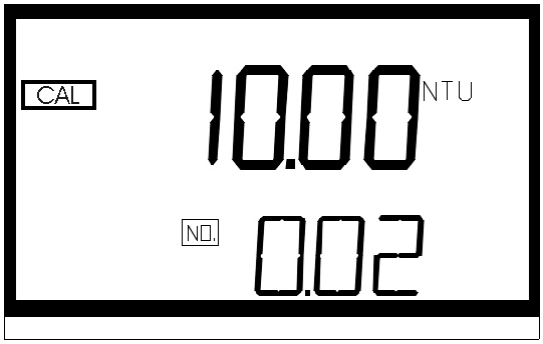
5. If you plan to measure turbidity levels above 1750 NTU you *must calibrate* using a 10000 NTU calibration standard (not included in the calibration kit). If you do not plan to measure turbidity levels above 10000 NTU then use the arrow buttons until the lower row of the display shows 100.0 and then proceed to step #6. Otherwise, insert the 10000 NTU calibration standard into the sample well and calibrate as before. When the instrument has completed the calibration, these blocks will quit flashing and the lower row of the display should now indicate that the 100.0 NTU standard is the next standard to be used for calibration.



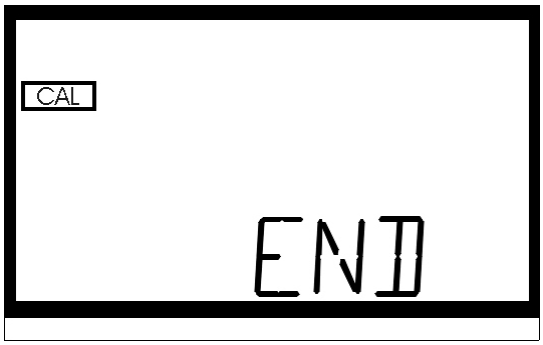
6. Insert the 100.0 NTU calibration standard into the sample well and calibrate as before. When the instrument has completed the calibration, , the **"Cal"** and the "**Store**" blocks will quit flashing and the lower row of the display should now indicate that the 10.0 NTU standard is the next standard to be used for calibration.



7. Insert the 10.0 NTU calibration standard into the sample well and calibrate as before. When the instrument has completed the calibration, , the **"Cal"** and the "**Store**" blocks will quit flashing and the lower row of the display should now indicate that the 0.02 NTU standard is the next standard to be used for calibration.



8. Insert the 0.02 NTU calibration standard into the sample well and calibrate as before. When the instrument has completed the calibration, the **"Cal"** and the "**Store**" blocks will quit flashing and the lower row of the display should now display the word "END" indicating that the instrument has completed the calibration phase and you can can now exit into the normal mode for measurement.



9. If you wish to exit into the return to the normal operating mode press the ↵ key at this time. If you wish to reperform the calibration, use either the ◁ or ▷ keys to maneuver back to the standard that you wish to work with.

Notes:

1. **You must use the 0.02 NTU standard at the beginning and end of the calibration cycle to ensure accurate calibration of the instrument.**
2. **During calibration, the instrument performs some system self-diagnostics. Several warning or error messages may be displayed. If there is an error in calibration, the associated warning or error message(s) will be displayed in the lower row of the LCD screen. Refer to the section on troubleshooting to determine the cause of the warning or error.**
3. **At any point in time during calibration, you can cycle through the required calibration points (0.02 NTU, 10 NTU, 100,0 NTU, 1750.0 NTU, and 10000.0 NTU) by pressing either the ◁ or ▷ key to individually calibrate with a particular calibration standard. If you wish to exit the calibration mode you may do so at any time by simply pressing the ◁ or ▷ key until the word "END" is shown on the lower row of the display and then pressing the ↵ key. However, exiting the calibration process without completing all of the steps for calibration may cause the accuracy of the instrument to be diminished.**

6. Instrument Configuration (SETUP) Mode

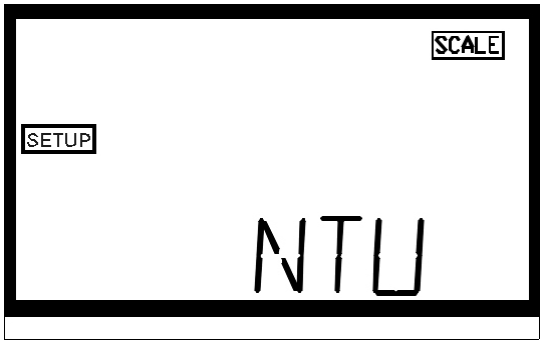
The instrument allows you to configure it according to your needs at any time during normal operation (except when you are performing an instrument calibration). This section describes how you can customize your instrument.

You can enter the SETUP mode of the instrument by pressing either the △ or ▽ key until the "**SETUP**" block is highlighted. At this point, press the ↵ key and you will either enter the SETUP mode or be prompted to enter the security code.

Note: To skip the selection of any parameter simply press either the ◁ or ▷ key to continue on to the next (or previous) section.

6.1. Setting the Scale

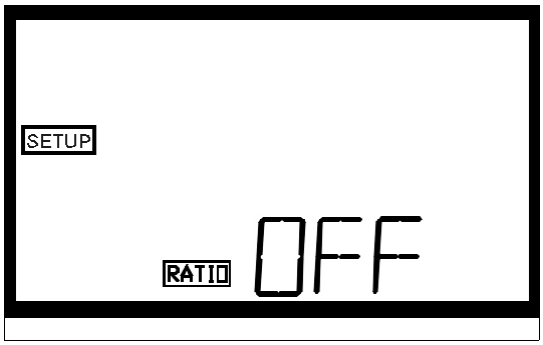
After pressing the ↵ key, the **Scale** block will be lit and the current scale (measured units) will be displayed on the lower row of the display.



Press either the △ or ▽ keys to change the units that will be displayed during normal automatic measurement mode. When you have selected the desired units press the ↵ key

6.2. Setting the Ratio Mode

After pressing the ↵ key, the **Ratio** block will be lit and the lower row of the display will indicate the state of the Ratio Mode in the instrument.

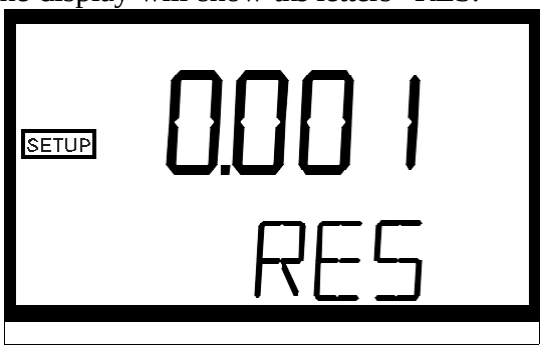


This feature is designed to decrease the sensitivity of the instrument to dissolved materials that may adversely affect a turbidity reading (e.g. dissolve material creating color). Press either the ⏶ or ⏷ keys to change the operational state of this option in the instrument. When you have selected the desired state press the ↵ key

6.3. Selecting Display Resolution

The instrument is equipped with the ability to display several levels of resolution (number of digits to the right of the decimal place). The instrument is capable of displaying turbidity with a resolution of four digits to the right of the decimal place (0.0001) for turbidity readings below 10 NTU. If you feel that the last digit, or two, is not stable, or useable, then you may suppress these digits by selecting the proper display resolution.

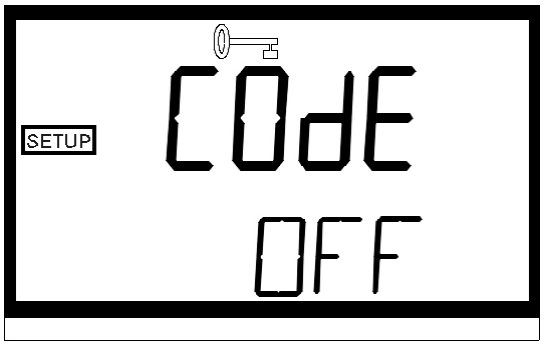
After setting up the ratio mode functionality, the upper row of the display will show the current resolution; the lower row of the display will show the letters “RES.”



You have the ability to select the resolution shown on the display by pressing either the ⏶ or ⏷ keys to change the resolution to be used. When you have selected the desired resolution press the ↵ key.

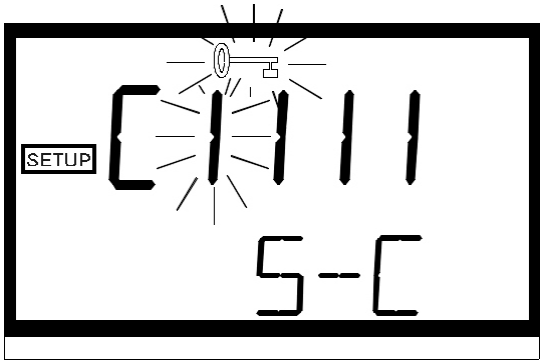
6.4. Configuring the Security Code

The instrument is equipped with a security access option. If this option is turned on, the user must input the access code to gain access to calibration or instrument configuration. The security key will be highlighted on the display and the word “S-C” will be shown on the lower row of the display.



The upper row of the display will indicate the operational status of the security access option (on or off). You can change the operational status of this option using either the ⏶ or ⏷ keys. Once you have set the desired status, press the ↵ key to accept it.

If you selected to turn on the security access code, you will need to input an access code to be used for entering calibration and for entering the configuration mode. The security key will be highlighted on the display and the word "S-C" will be shown on the lower row of the display while the current access code for entering calibration is shown on the upper row of the display (C followed by 4 numbers).

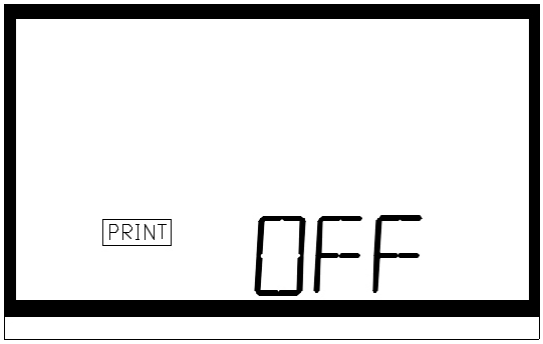


If you wish to change the code you may change each of the four numbers one at a time. Use either the ⏶ or ⏷ keys to select the first number in the code then press the ↵ key to move to the next number. Follow this process through the four numbers in the access code. When you are satisfied with your selection, press the ↵ key to accept the number. The access code will change from the calibration access code to the configuration (user setup) access code (S followed by 4 numbers).

Select the access code for the configuration/setup mode as you did with the calibration mode.

6.5. Setting up the RS232 Port (Printing Function)

After pressing the ↵ key, the Print block will be lit and the lower row of the display will indicate the state of the RS232 port.

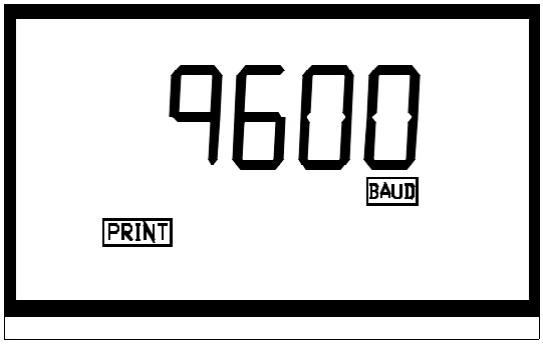


This feature allows you to select the function of the serial port on the instrument. There are two options to choose from: Off and Timed Output. Select the RS232 option by pressing either the ▲ or ▼ keys. When you have selected the proper function, press the ↵ key.

Off: When the RS232 port is turned "Off" you may obtain a printout of the displayed turbidity level each time you press the ↵ key in normal mode.

Timed Output: Several automatic printing times are available: 5 sec, 30 sec, 1 min, 5 min, 10 min, 15 min, 30 min and 60 min. If you selected this option, the instrument will print out the average turbidity level, time, and date for the interval that you select. The timing for the interval starts at midnight.

If you selected to turn off the RS232 port, pressing the ↵ key will send you to the portion of the code that sets up the date. If, on the other hand, you selected to either turn on the printing function, pressing the ↵ key will cause the **Baud** block to be highlighted and you can select the correct baud rate for operation of your printer.

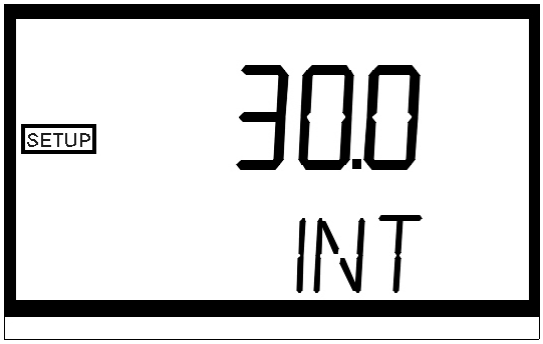


Select the desired baud rate (1200, 2400, 4800, or 9600) by pressing either the ▲ or ▼ keys to change the displayed baud rate. The other RS 232 parameters are fixed at 1 stop bit, 8 data bits and no parity. When you have selected the proper baud rate press the ↵ key.

Note: If the security code is enabled and the calibration interval has not been exceeded the letters "QC" will follow each printout indicating the instrument is functioning properly in a secure fashion. If the security code is turned off, or if the calibration interval has been exceeded the "QC" mark will not appear on the printout.

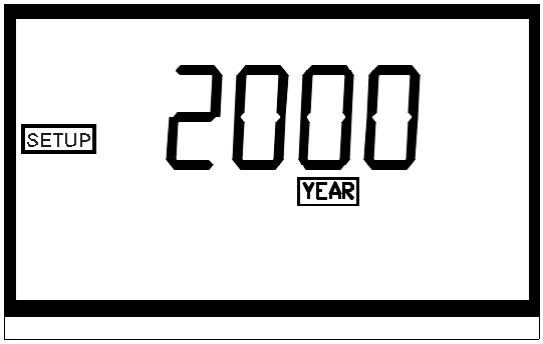
6.6. Setting the Calibration Interval

After pressing the ↵ key, the lower row of the display will have the letters "Int" printed in it. The number in the upper row of the display corresponds to the number of days that you wish to have between scheduled calibrations (default is 30 days).



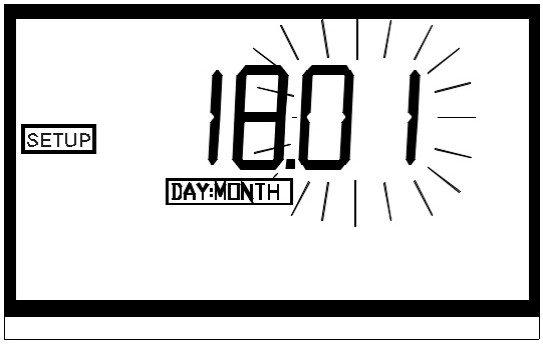
Select the desired number of days between scheduled calibrations by pressing either the ▲ or ▼ keys to change the displayed day. In normal automatic mode, if you exceed this number of days between calibrations, the **Cal** block will flash until you re-calibrate the instrument. When you have selected the desired calibration interval press the ↵ key.

6.7. Setting the Date (Year, Month and Day)



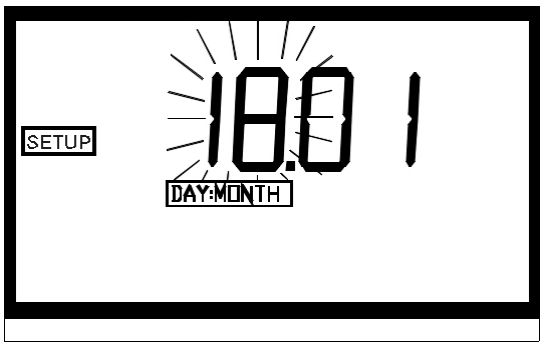
With the **Year** block highlighted and the year displayed, change the displayed year using either the ▲ or ▼ keys. When you have selected the proper year press the ↵ key to accept the year.

After pressing the ↵ key, the **Day:Month** block will be displayed and you will see two numbers on the upper row of the display. The number flashing corresponds to the month.



Select the correct month by pressing either the ▲ or ▼ keys to change the displayed month. When you have selected the proper month, press the ↵ key. After pressing the ↵ key, the

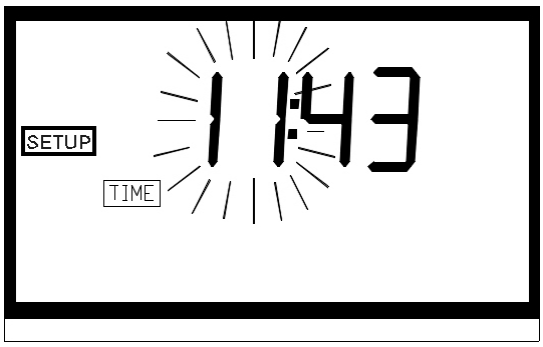
Day:Month block will remain displayed and the second number on the upper row of the display will be flashing: this number corresponds to the day of the month.



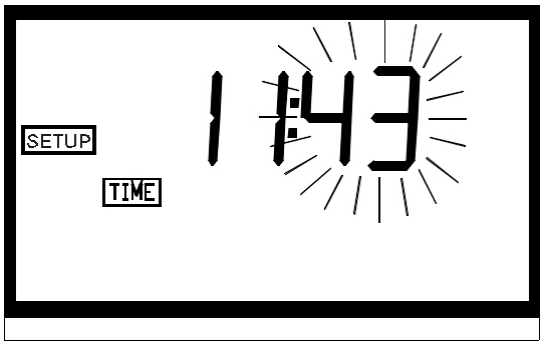
Select the correct day by pressing either the ⏶ or ⏷ keys to change the displayed day. When you have selected the proper day, press the ↵ key.

6.8. Setting the Time (Hours and Minutes)

After pressing the ↵ key, the **Time** block will be displayed and you will see the time displayed on the upper row of the display in 24-hour format. The number flashing corresponds to the hour.



Select the correct hour by pressing either the ⏶ or ⏷ keys to change the displayed hour. When you have selected the proper hour, press the ↵ key. After pressing the ↵ key, the **Time** block will remain displayed and the second number on the upper row of the display will be flashing: this number corresponds to minutes.

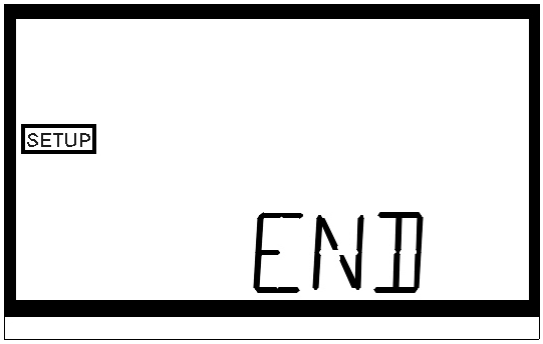


Select the correct minutes level by pressing either the ⏶ or ⏷ keys to change the displayed minutes. When you have selected the proper minutes level, press the ↵ key.

Note: The number of seconds in the minute will be reset to zero when the ↵ key is pressed after selecting the proper minutes level.

6.9. Exiting the setup mode

After you have pressed the ↵ key for selecting the time, the word “END” will be shown on the lower row of the display.



You may also reach this point by pressing either the ◁ or ▷ key until the word “END” appears on the lower row of the display. At this point, simply press the ↵ key to return to the normal mode.

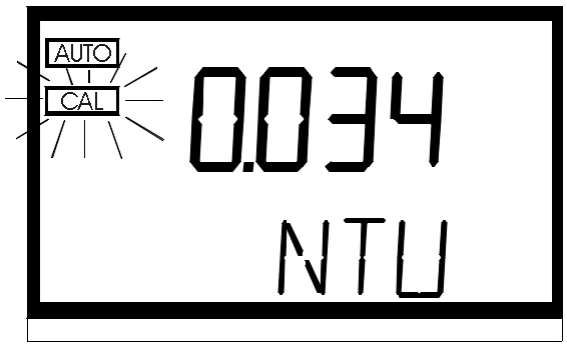
7. Troubleshooting

7.1. System Warning Message(s)

The instrument generates warning messages to provide you with specific diagnostic information about the instrument. These messages are for your use and do not reduce the performance of the instrument. The following sections outline warning messages that could be observed during normal operation.

7.1.1. Flashing "Cal" block

A flashing **"Cal"** block observed during normal automatic mode indicates that you should re-calibrate your instrument.

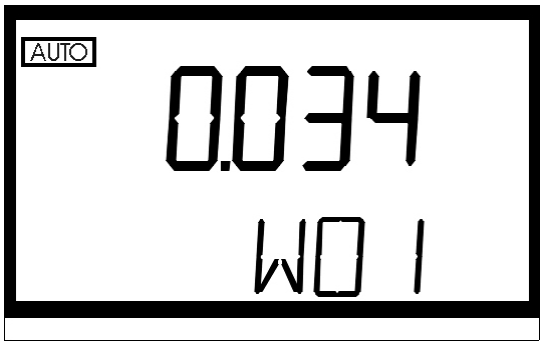


The factory default is 30 days. HF scientific inc. recommends calibration every 30 days. The flashing **"Cal" block** is only a warning and does not mean that the instrument will stop performing accurately. The **"Cal"** block will flash until you have re-calibrated the instrument.

7.1.2. Sample Over-Range ("O-r")

The instrument is capable of reading the turbidity of samples up to 10,000 NTU (or equivalent in the other scales). If the turbidity of the sample is determined to be higher than 10,000 NTU, the instrument will report "O-r" in the upper row of the display.

7.1.3. Other warning messages (W-XX)

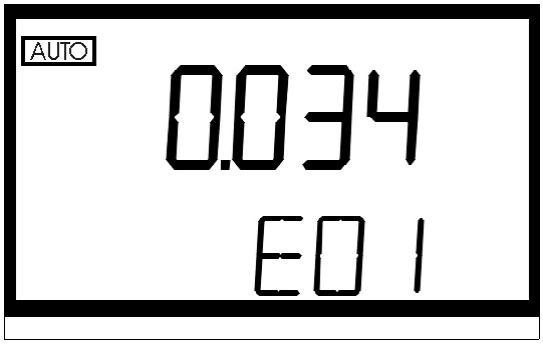


The following table outlines the general warning messages that could arise (normally after calibration is performed).

WARNING	ASSOCIATED MEANING	TYPICAL CAUSE
W-01	Lamp Failure	The lamp is no longer working, or the light output of the lamp is too low for normal operation.
W-02	Transmission detector #1 error	Transmission detector #1 failed to report the proper signal levels during calibration (the detector circuitry has failed or calibration was performed with the wrong standards).
W-03	Transmission detector #2 error	Transmission detector #2 failed to report the proper signal levels during calibration (the detector circuitry has failed or calibration was performed with the wrong standards).
W-04	Nephelometric detector (90°) error	The nephelometric detector failed to report the proper signal levels during calibration (the detector circuitry has failed or calibration was performed with the wrong standards).
W-05	Reference detector	The reference detector failed to report the proper signal levels during calibration (the detector circuitry has failed or calibration was performed with the wrong standards).
W-06	Calibration failure on range 0-10 NTU.	The signal difference obtained between the 0.02 NTU and 10.0 NTU calibration standards was too small to ensure the resolution in the specifications. Verify that you used the correct standards during calibration.
W-07	Calibration failure on range 10-100 NTU.	The signal difference obtained between the 10.0 NTU and 100.0 NTU calibration standards was too small to ensure the resolution in the specifications. Verify that you used the correct standards during calibration.
W-08	Calibration failure on range 100-1750 NTU.	The signal difference obtained between the 100.0 NTU and 1750.0 NTU calibration standards was too small to ensure the resolution in the specifications. Verify that you used the correct standards during calibration.
WNG	Multiple warnings have occurred	Calibration was performed with the wrong standards or the lamp failed during calibration.

7.2. System Error Message(s)

The instrument generates error messages when problems are detected during normal operation. When these messages are observed and if you do not understand the instructions shown below, contact the HF scientific, inc. Technical Services department to determine a resolution to the problem. The instrument indicates an error message when an "E-XX" is displayed on the lower row of the display.



The instrument has several error codes, each assessing a different component or system of components in the instrument. The following table lists the error messages and their associated meanings.

ERROR	ASSOCIATED MEANING	TYPICAL CAUSE
E-01	The A/D has failed to report correctly	One or several components in the A/D circuit has failed … call technical service immediately
SFE	General Electronics Failure	One or many electrical components have failed in the instrument.

If an error is noted, please contact the HF scientific, inc. Technical Services Department immediately to rectify the error.

7.3. Factory Default Parameters

The instrument retains all original factory settings in non-volatile memory. At any time, you can cause the instrument to change back to these default settings. This is particularly useful if you feel that your calibration standards may have been compromised or if someone has erred in their use of the instrument. In these situations you may use the factory default parameters while waiting for new standards (or instructions) to arrive from HF scientific, inc.

To invoke this option, turn the instrument on and then press the ⏏ key while holding down the ◀ key. The instrument will perform several operations (taking approximately 2 minutes) and then turn off indicating that the memory and all settings have been reset to the factory default parameters. After this point you may start to use the instrument again as you normally would.

8. Routine Maintenance

The instrument has been designed for ease of use and simple operation. When not in use, ensure that the instrument has been turned off and that a clean sample cuvette fitted with a black light shield cap has been placed in the sample well. This will ensure that a minimal amount of dust and/or debris will be able to settle on the optics of the instrument.

8.1.Cuvette Cleaning and Care

Proper measurement of the turbidity of a sample requires the use of a cuvette that is free of marks, smudges, scratches and any bacterial growth. Any typical glass cleaner can be used along with a lint free cloth, or tissue, to clean the outside of the cuvette. The inside of the cuvette can also be cleaned with any typical glass cleaner. Once cleaned, the cuvette should be rinsed thoroughly 8 to 10 times with clean distilled water to eliminate the possibility of detergent build-up and streaking. Cleaned and dried cuvettes should be stored with the black light shield cap on the cuvette and can be stored in a cuvette rack (see accessories and replacement parts list). During normal operation you may use any typical glass cleaner along with a lint free cloth, or tissue, to clean the outside of the cuvettes.

8.2.Lamp Replacement

Periodically the lamp module will require replacement. Figure 1 illustrates the location of the lamp module. An error message will be illuminated when it is time to replace the lamp (see Troubleshooting). We recommended that you keep one spare lamp module for each instrument on hand at all times to ensure continuous use of the instrument.

Before replacing the lamp module ensure that the instrument is turned off. Once you have turned off the instrument, proceed with the following instructions:

1. Remove the lamp module from the instrument by squeezing the two side tabs on the module inward while pulling the module out of the instrument. Pull the module away from the instrument until the in-line power connector is exposed (about 6-8 inches).
2. Unfasten the connector by holding on to the white in-line connector and pulling the in-line connector apart. When pulling the in-line connector apart, DO NOT hold on to the wires.
3. The new lamp module can now be connected to the instrument using the in-line power connector.
4. Feed the wire back into the instrument being careful that the wire does not get in the way of the lamp or the lamp holder (on instrument). Make sure that the light bulb icon on the back of the lamp module is upright. Press the module into the instrument until you hear it click firmly into place.

8.3.Battery Replacement

The Micro 1000 contains a non-rechargeable 10-year life lithium battery for backup of the real-time clock. This battery is not field replaceable. Failure of this battery will not impede the use of the instrument, however some time-related activities such as timed printouts will not operate. Contact the HF scientific inc. Service Dept. for replacement of this item.

Note: The side tabs may need to be pressed outward until they click to secure the new lamp module.

5. If the two side tabs on the lamp module do not click the lamp module securely in place, check that the power wire is not obstructing the lamp module.
6. Turn on the instrument and follow the instructions in section 4.1 to re-calibrate the instrument with the new lamp module. **The instrument must be re-calibrated after lamp module replacement.**
7. Resume normal operation after recalibrating the instrument.

9. Contacting the HF scientific, inc. Technical Service Department

For technical assistance or to order replacement parts please contact the HF Technical Services Department or Customer Service Department.

HF scientific, inc.
3170 Metro Parkway
Fort Myers, Florida 33916-7597
Phone: (239) 337-2116
Fax: (239) 332-7643
Email: info@hfscientific.com

10. Accessories and Replacement Parts List

Accessory or Replacement Part	Catalog Number
Micro 1000 PRIME TIME Calibration Set (includes 0.02 NTU, 10.0NTU, 100 NTU & 1750 NTU Calibration Standards)	19927
High Range PRIME TIME Calibration Standard for White Light, 10000 NTU	19938
Micro 1000 IR PRIME TIME Calibration Set (includes 0.02 NTU, 10.0NTU, 100 NTU & 1750 NTU Calibration Standards)	19928
High Range PRIME TIME Calibration Standard for IR light, 10000 NTU	19939
Formazin Stock Solution Kit	50040
Formazin, 4000 NTU Stock Solution, 500 ml	70914
Lamp Module – Tungsten Filament	19972
Lamp Module – IR	22423
Turbidity Free Water	70908
Pour Through Assembly	19975
Flow Through Assembly	19989
Cuvette Stand (holds 11 cuvettes)	19981
Sample Cuvettes – 3 pack	50051
Sample Cuvettes – 10 pack	50052
Micro 1000 Manual	22588
RS232 Cable for Serial Printer	19798

11. Glossary

Formazin Turbidity Units (FTU): *see Nephelometric Turbidity Units*

Indexing a Cuvette: The United States Environmental Protection Agency (US EPA) recommends that cuvettes used for turbidimeter calibration or sample measurement be indexed. To index a cuvette with a sample in it, slowly rotate the cuvette throughout one complete revolution (360°). While rotating the sample cuvette, observe the display and locate the position that the cuvette is in which provides the lowest turbidity reading. This position is the indexed position of the cuvette.

Nephelometric Turbidity Units (NTU): Unit of measure used when comparing the light scattered by a liquid media to the light scattered by a known concentration of Formazin Polymer. This unit of measure is recognized as a measure of the optical clarity of an aqueous sample. NTU is the accepted unit of measurement for turbidity.

Turbidity: 1) A measure of the attenuation of a radiant flux as it passes through a liquid media, 2) Optical clarity of a liquid, 3) a phenomena caused by the presence of undissolved matter in a liquid media.

Formazin Nephelometric Units (FNU): *see Nephelometric Turbidity Units*

European Brewery Convention Units (EBC): A scale related to turbidity where 0.245 EBC's = 1 NTU.

Nephelos: A scale related to turbidity where 6.7 Nephelos = 1 NTU.

12. Warranty

HF scientific, inc., as vendor, warrants to the original purchaser of the instruments to be free of defects in material and workmanship, in normal use and service, for a period of one year from date of delivery to the original purchaser. HF scientific, inc.'s, obligation under this warranty is limited to replacing, at its factory, the instrument or any part thereof. Parts which by their nature are normally required to be replaced periodically, consistent with normal maintenance, specifically lamps including fluorescent backlight, reagent, desiccant, sensors, electrodes and fuses are excluded. Also excluded are accessories and supply type items.

Original purchaser is responsible for return of the instruments, or parts thereof, to HF scientific, inc.'s factory. This includes all freight charges incurred in shipping to and from HF scientific, inc.'s factory.

HF scientific, inc. is not responsible for damage to the instrument, or parts thereof, resulting from misuse, negligence or accident, or defects resulting from repairs, alterations or installation made by any person or company not authorized by HF scientific, inc.

HF scientific, inc. assumes no liability for consequential damage of any kind, and the original purchaser, by placement of any order for the instrument, or parts thereof, shall be deemed liable for any and all damages incurred by the use or misuse of the instruments, or parts thereof, by the purchaser, its employees, or others, following receipt thereof.

Carefully inspect this product for shipping damage, if damaged, immediately notify the shipping company and arrange an on-site inspection. HF scientific, inc. cannot be responsible for damage in shipment and cannot assist with claims without an on-site inspection of the damage.

This warranty is given expressly and in lieu of all other warranties, expressed or implied. Purchaser agrees that there is no warranty on merchantability and that there are no other warranties, expressed or implied. No agent is authorized to assume for HF scientific, inc. any liability except as set forth above.

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